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# STP80NF03L-04 STB80NF03L-04 STB80NF03L-04-1

N-CHANNEL 30V - 0.0035 Ω - 80A D<sup>2</sup>PAK/I<sup>2</sup>PAK/TO-220  
 STripFET™ II POWER MOSFET

| TYPE             | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------------|------------------|---------------------|----------------|
| STB80NF03L-04/-1 | 30 V             | <0.004 Ω            | 80 A           |
| STP80NF03L-04    | 30 V             | <0.004 Ω            | 80 A           |

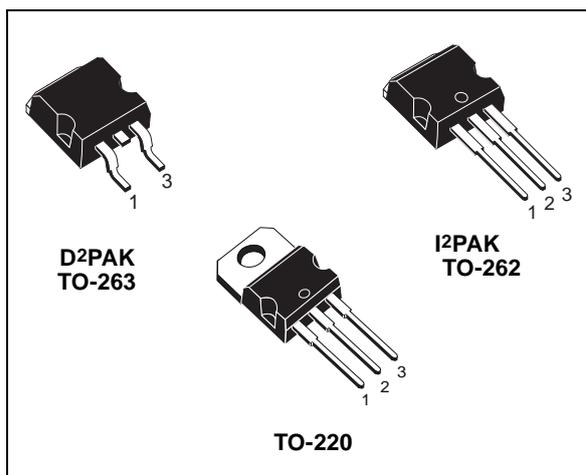
- TYPICAL R<sub>DS(on)</sub> = 0.0035Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- LOW THRESHOLD DRIVE

### DESCRIPTION

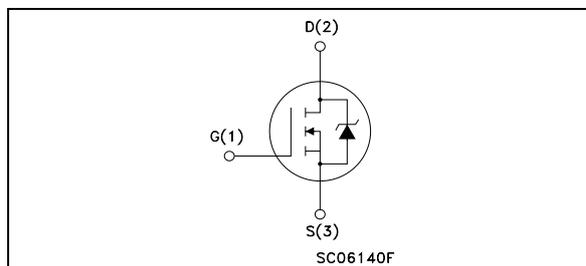
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



### INTERNAL SCHEMATIC DIAGRAM



### Ordering Information

| SALES TYPE      | MARKING      | PACKAGE            | PACKAGING   |
|-----------------|--------------|--------------------|-------------|
| STB80NF03L-04   | 80NF03L-04 @ | D <sup>2</sup> PAK | TUBE        |
| STB80NF03L-04T4 | 80NF03L-04 @ | D <sup>2</sup> PAK | TAPE & REEL |
| STP80NF03L-04   | 80NF03L-04 @ | TO-220             | TUBE        |
| STB80NF03L-04-1 | 80NF03L-04 @ | I <sup>2</sup> PAK | TUBE        |

### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter  | Value      | Unit |
|---------------------|--|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 30         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 30         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ± 20       | V    |
| I <sub>D</sub> (**) | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 80         | A    |
| I <sub>D</sub> (**) | Drain Current (continuous) at T <sub>C</sub> = 100°C | 80         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 320        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 300        | W    |
|                     | Derating Factor                                      | 2          | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                    | 2          | V/ns |
| E <sub>AS</sub> (2) | Single Pulse Avalanche Energy                        | 2.3        | J    |
| T <sub>stg</sub>    | Storage Temperature                                  | -60 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 175        | °C   |

(●) Pulse width limited by safe operating area.  
 (\*\*) Current Limited by Package

(1) I<sub>SD</sub> ≤ 80A, di/dt ≤ 240A/μs, V<sub>DD</sub> ≤ 24V, T<sub>j</sub> ≤ T<sub>JMAX</sub>  
 (2) Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 40A, V<sub>DD</sub> = 20V

**STB80NF03L-04/-1/STP80NF03L-04**
**THERMAL DATA**

|                |  |     |      |      |
|----------------|--|-----|------|------|
| Rthj-case      | Thermal Resistance Junction-case               | Max | 0.5  | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient            | Max | 62.5 | °C/W |
| T <sub>l</sub> | Maximum Lead Temperature For Soldering Purpose | Typ | 300  | °C   |

**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

**OFF**

| Symbol               | Parameter   | Test Conditions   | Min. | Typ. | Max.    | Unit     |
|----------------------|---|---|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 μA V <sub>GS</sub> = 0   | 30   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating T <sub>C</sub> = 125°C |      |      | 1<br>10 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 20 V  |      |      | ±100    | nA       |

**ON (\*)**

| Symbol              | Parameter                         | Test Conditions   | Min. | Typ.            | Max.            | Unit   |
|---------------------|-----------------------------------|---|------|-----------------|-----------------|--------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 μA                                     | 1    |                 |                 | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 40 A<br>V <sub>GS</sub> = 4.5 V I <sub>D</sub> = 40 A |      | 0.0035<br>0.004 | 0.004<br>0.0055 | Ω<br>Ω |

**DYNAMIC**

| Symbol   | Parameter   | Test Conditions                                       | Min. | Typ.                | Max. | Unit           |
|--|---|---|------|---------------------|------|----------------|
| g <sub>fs</sub> (*)                                      | Forward Transconductance  | V <sub>DS</sub> = 15 V I <sub>D</sub> = 15 A          |      | 50                  |      | S              |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 5500<br>1670<br>290 |      | pF<br>pF<br>pF |

**STB80NF03L-04-1/STP80NF03L-04**

**ELECTRICAL CHARACTERISTICS (continued)**

**SWITCHING ON**

| Symbol                        | Parameter  | Test Conditions   | Min. | Typ.           | Max. | Unit           |
|-------------------------------|--|---|------|----------------|------|----------------|
| $t_{d(on)}$<br>$t_r$          | Turn-on Delay Time<br>Rise Time                              | $V_{DD} = 15\text{ V}$ $I_D = 40\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3) |      | 30<br>270      |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 24\text{ V}$ $I_D = 80\text{ A}$ $V_{GS} = 4.5\text{ V}$  |      | 85<br>23<br>40 | 110  | nC<br>nC<br>nC |

**SWITCHING OFF**

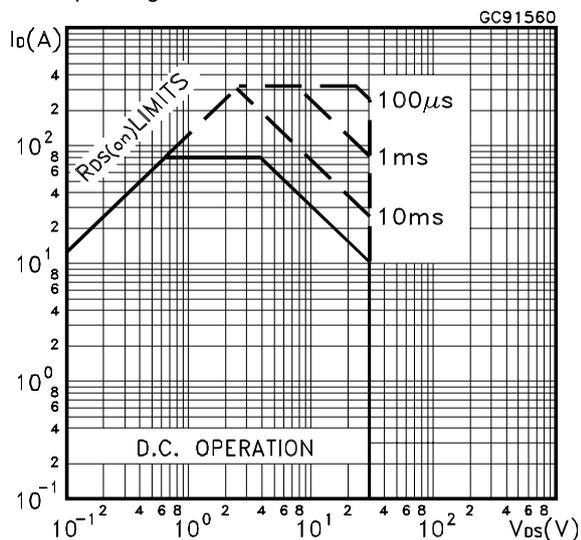
| Symbol                          | Parameter   | Test Conditions  | Min. | Typ.             | Max. | Unit           |
|---------------------------------|---|--|------|------------------|------|----------------|
| $t_{d(off)}$<br>$t_f$           | Turn-off Delay Time<br>Fall Time                      | $V_{DD} = 15\text{ V}$ $I_D = 40\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3)  |      | 110<br>95        |      | ns<br>ns       |
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-Voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{clamp} = 24\text{ V}$ $I_D = 80\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Inductive Load, Figure 5) |      | 125<br>75<br>125 |      | ns<br>ns<br>ns |

**SOURCE DRAIN DIODE**

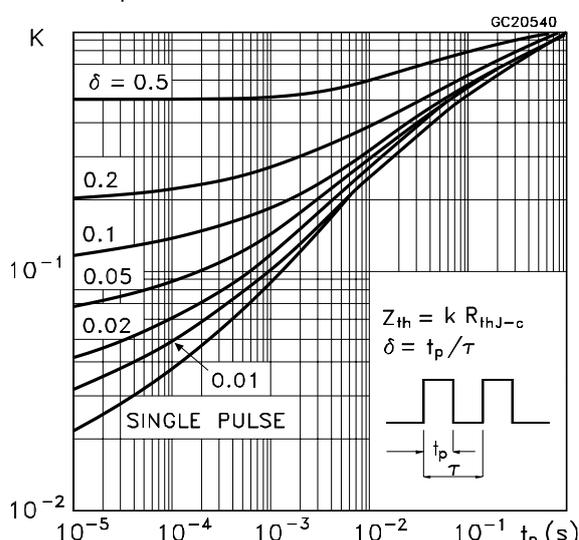
| Symbol                            | Parameter  | Test Conditions   | Min. | Typ.            | Max.      | Unit                     |
|-----------------------------------|--|---|------|-----------------|-----------|--------------------------|
| $I_{SD}$<br>$I_{SDM} (*)$         | Source-drain Current<br>Source-drain Current (pulsed)                        |   |      |                 | 80<br>320 | A<br>A                   |
| $V_{SD} (*)$                      | Forward On Voltage   | $I_{SD} = 80\text{ A}$ $V_{GS} = 0$   |      |                 | 1.5       | V                        |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 80\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 75<br>0.15<br>4 |           | ns<br>$\mu\text{C}$<br>A |

(\*)Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 (●)Pulse width limited by safe operating area.

**Safe Operating Area**

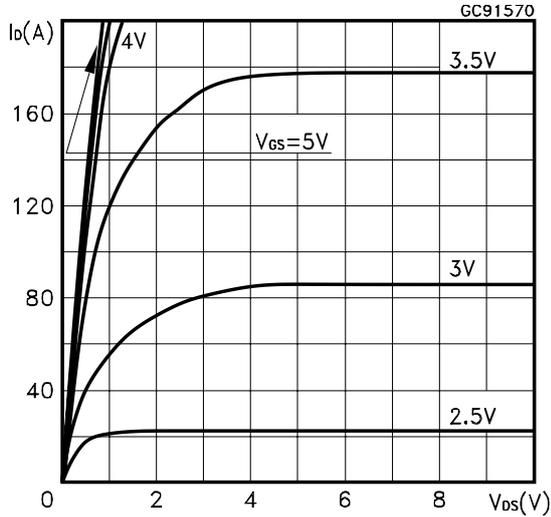


**Thermal Impedance**

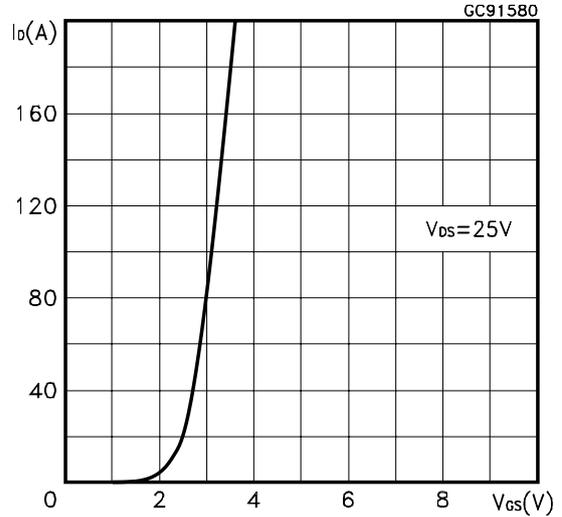


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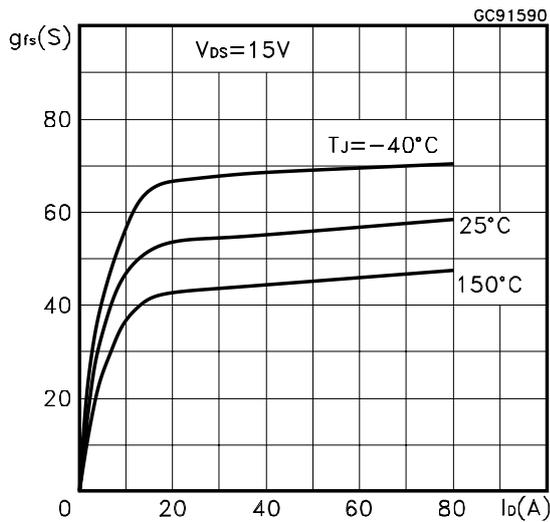
Output Characteristics



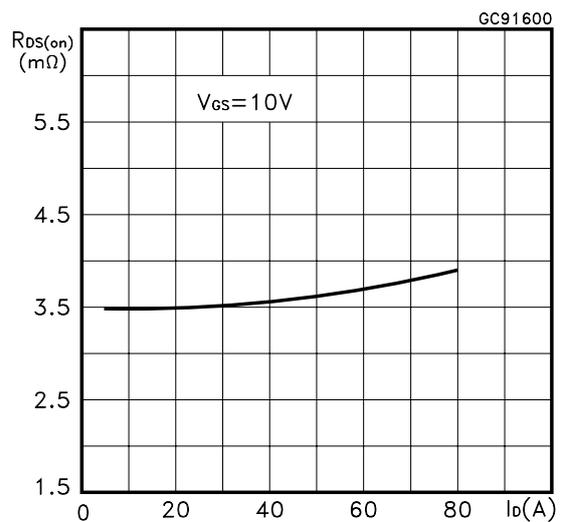
Transfer Characteristics



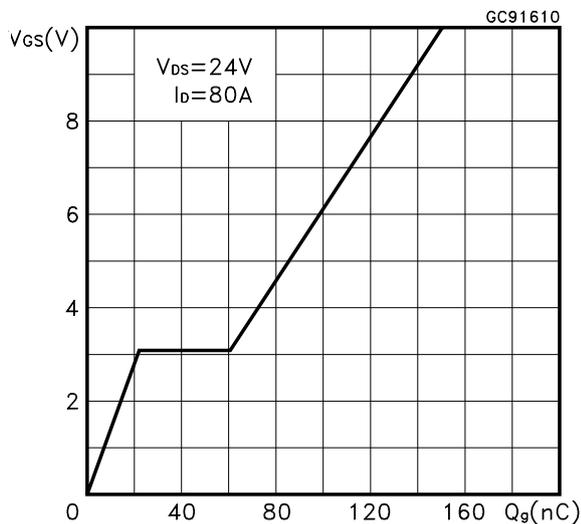
Transconductance



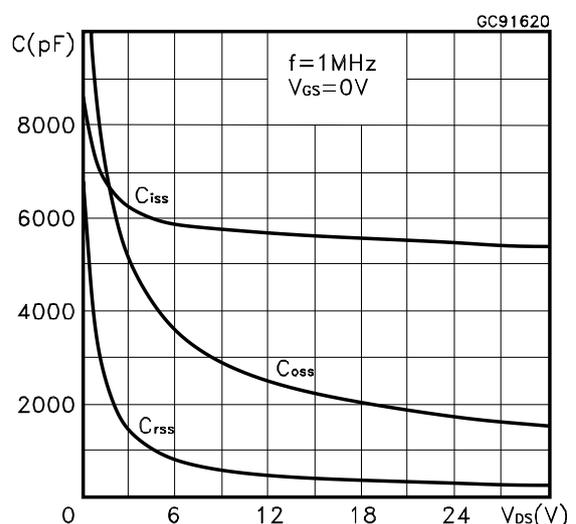
Static Drain-source On Resistance



Gate Charge vs Gate-source Voltage

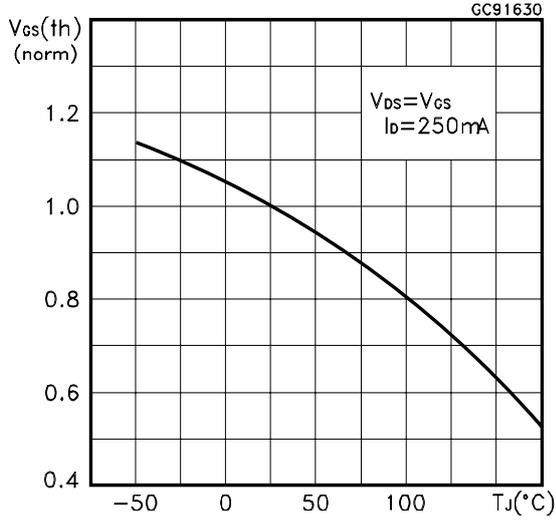


Capacitance Variations

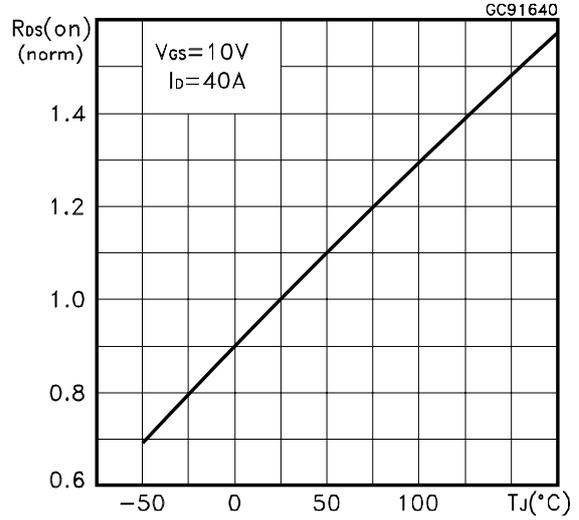


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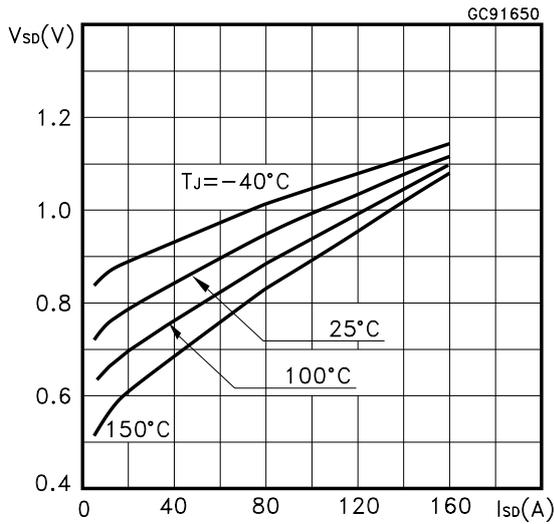
Normalized Gate Threshold Voltage vs Temperature



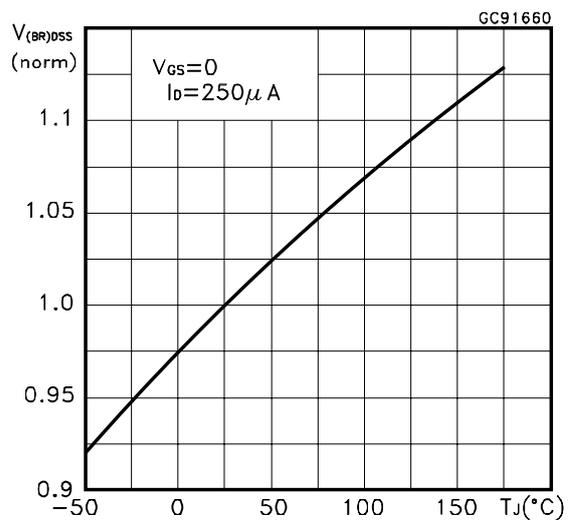
Normalized on Resistance vs Temperature



Source-drain Diode Forward Characteristics

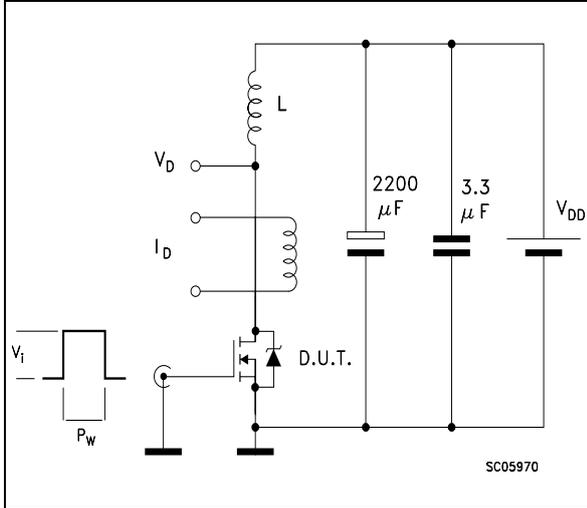


Normalized Breakdown Voltage vs Temperature.

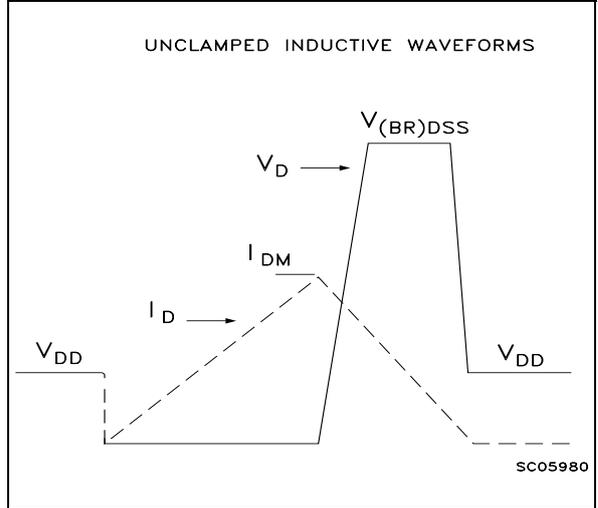


**STB80NF03L-04-1/STP80NF03L-04**

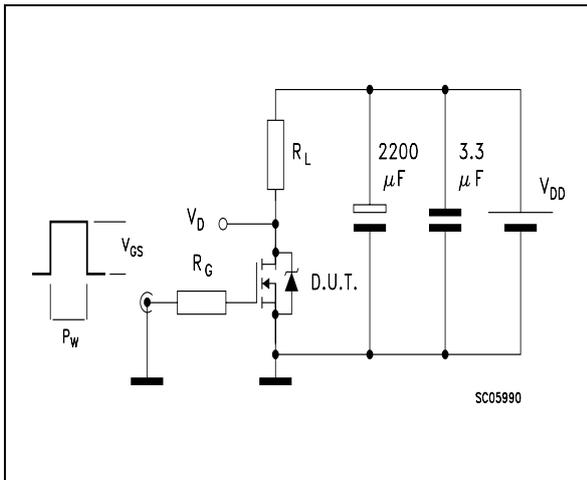
**Fig. 1: Unclamped Inductive Load Test Circuit**



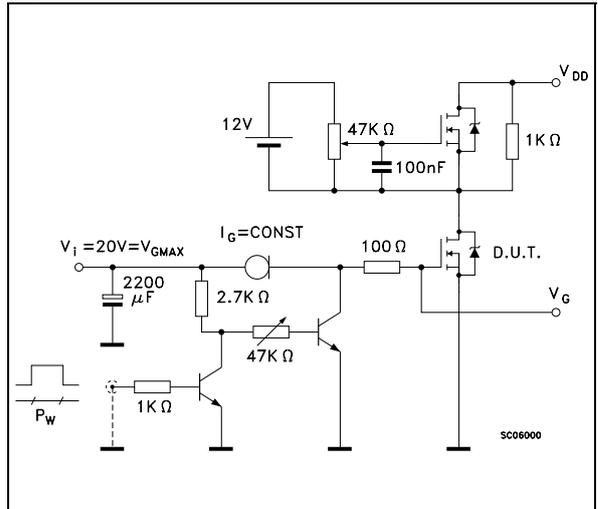
**Fig. 2: Unclamped Inductive Waveform**



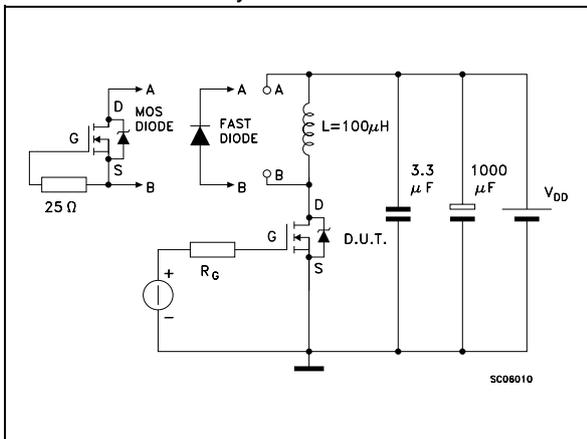
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 4: Gate Charge test Circuit**



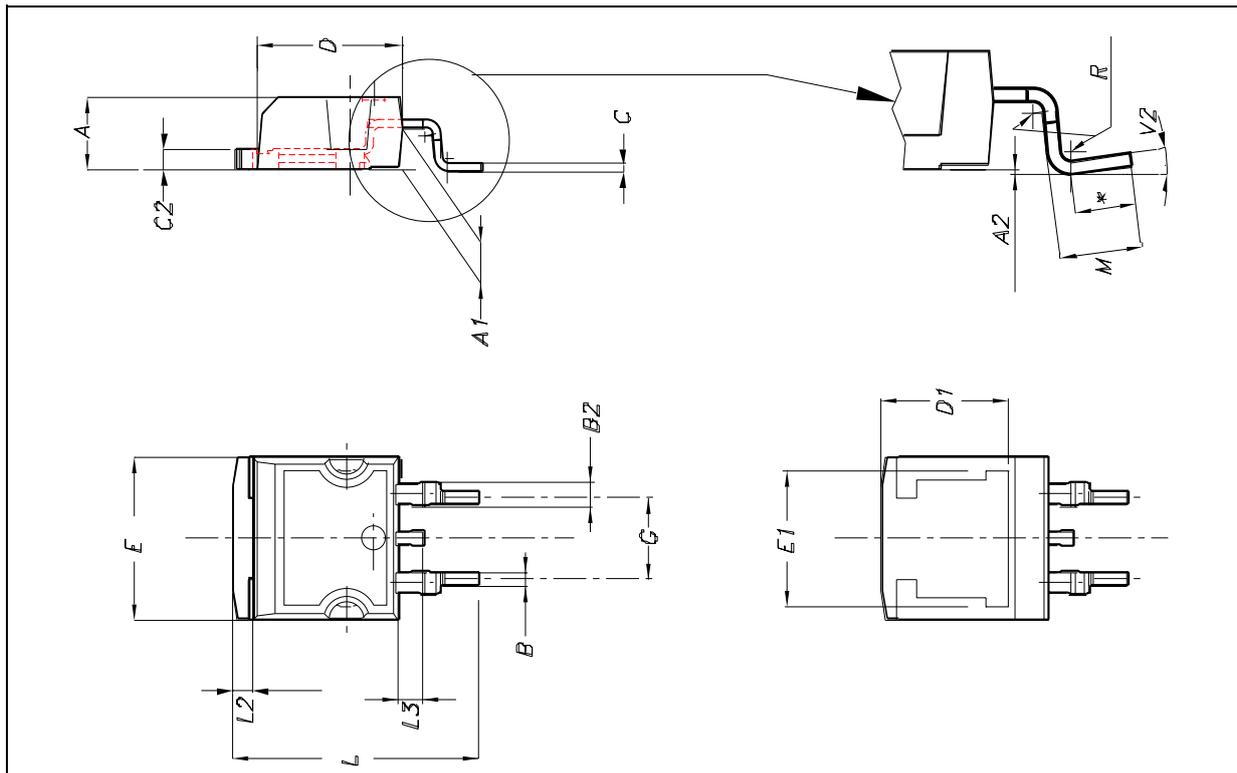
**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



**STB80NF03L-04/-1/STP80NF03L-04**

**D<sup>2</sup>PAK MECHANICAL DATA**

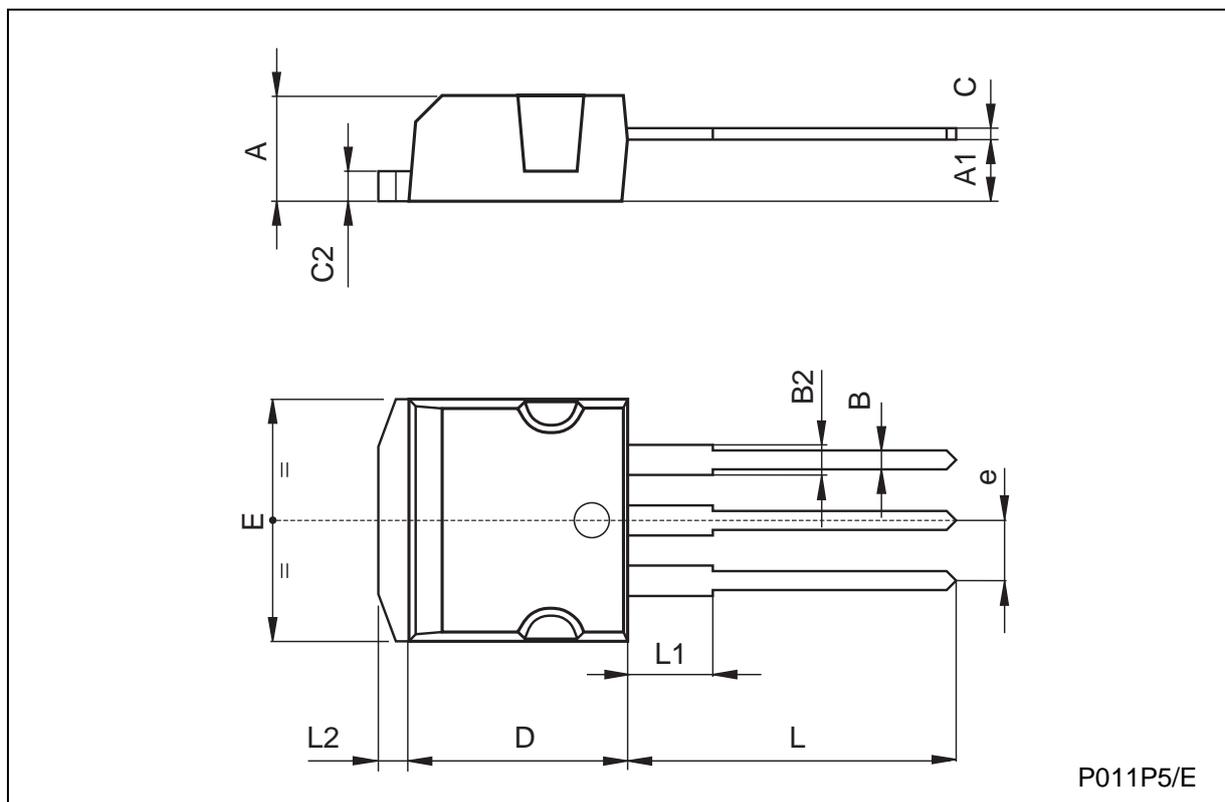
| DIM. | mm.  |      |       | inch. |       |       |
|------|------|------|-------|-------|-------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP.  | TYP.  |
| A    | 4.4  |      | 4.6   | 0.173 |       | 0.181 |
| A1   | 2.49 |      | 2.69  | 0.098 |       | 0.106 |
| A2   | 0.03 |      | 0.23  | 0.001 |       | 0.009 |
| B    | 0.7  |      | 0.93  | 0.028 |       | 0.037 |
| B2   | 1.14 |      | 1.7   | 0.045 |       | 0.067 |
| C    | 0.45 |      | 0.6   | 0.018 |       | 0.024 |
| C2   | 1.21 |      | 1.36  | 0.048 |       | 0.054 |
| D    | 8.95 |      | 9.35  | 0.352 |       | 0.368 |
| D1   |      | 8    |       |       | 0.315 |       |
| E    | 10   |      | 10.4  | 0.394 |       | 0.409 |
| E1   |      | 8.5  |       |       | 0.334 |       |
| G    | 4.88 |      | 5.28  | 0.192 |       | 0.208 |
| L    | 15   |      | 15.85 | 0.591 |       | 0.624 |
| L2   | 1.27 |      | 1.4   | 0.050 |       | 0.055 |
| L3   | 1.4  |      | 1.75  | 0.055 |       | 0.069 |
| M    | 2.4  |      | 3.2   | 0.094 |       | 0.126 |
| R    |      | 0.4  |       |       | 0.015 |       |
| V2   | 0°   |      | 8°    | 0°    |       | 8°    |



**STB80NF03L-04/-1/STP80NF03L-04**

**TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |      |       |
|------|------|------|------|-------|------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP. | MAX.  |
| A    | 4.4  |      | 4.6  | 0.173 |      | 0.181 |
| A1   | 2.49 |      | 2.69 | 0.098 |      | 0.106 |
| B    | 0.7  |      | 0.93 | 0.027 |      | 0.036 |
| B2   | 1.14 |      | 1.7  | 0.044 |      | 0.067 |
| C    | 0.45 |      | 0.6  | 0.017 |      | 0.023 |
| C2   | 1.23 |      | 1.36 | 0.048 |      | 0.053 |
| D    | 8.95 |      | 9.35 | 0.352 |      | 0.368 |
| e    | 2.4  |      | 2.7  | 0.094 |      | 0.106 |
| E    | 10   |      | 10.4 | 0.393 |      | 0.409 |
| L    | 13.1 |      | 13.6 | 0.515 |      | 0.531 |
| L1   | 3.48 |      | 3.78 | 0.137 |      | 0.149 |
| L2   | 1.27 |      | 1.4  | 0.050 |      | 0.055 |

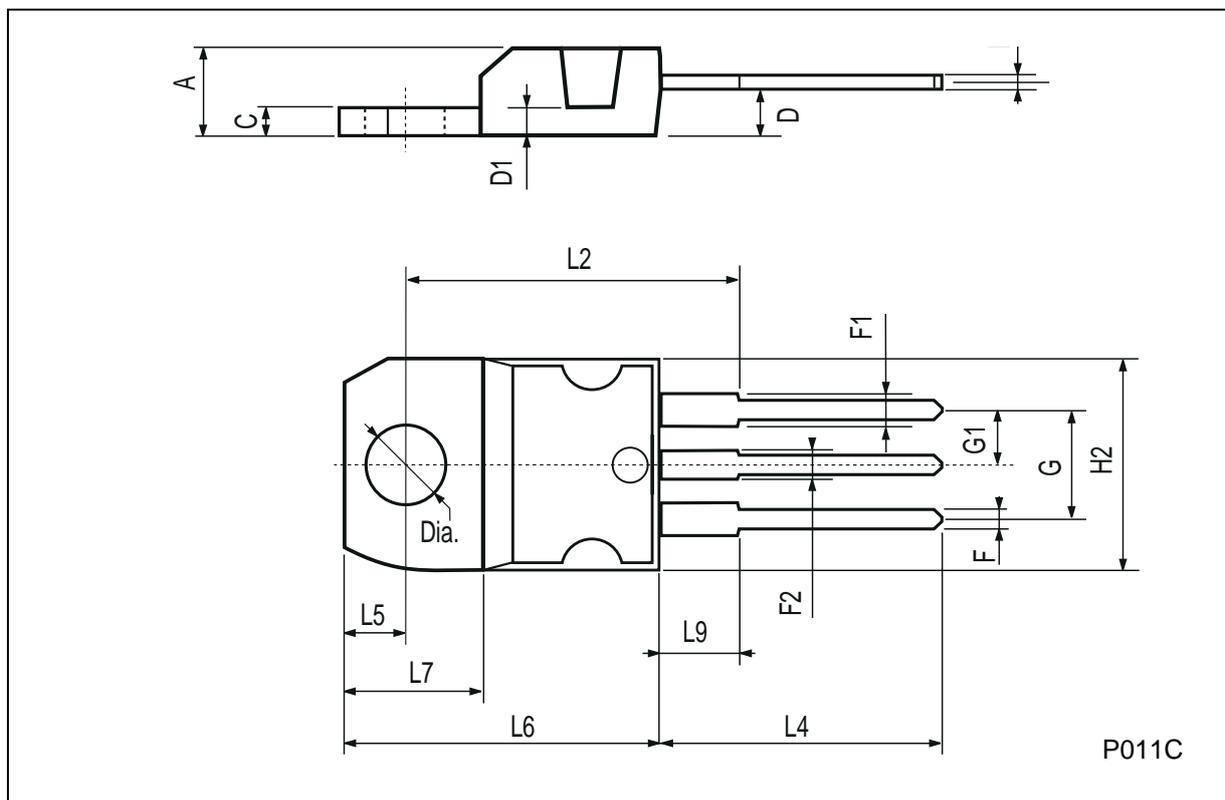


P011P5/E

**STB80NF03L-04/-1/STP80NF03L-04**

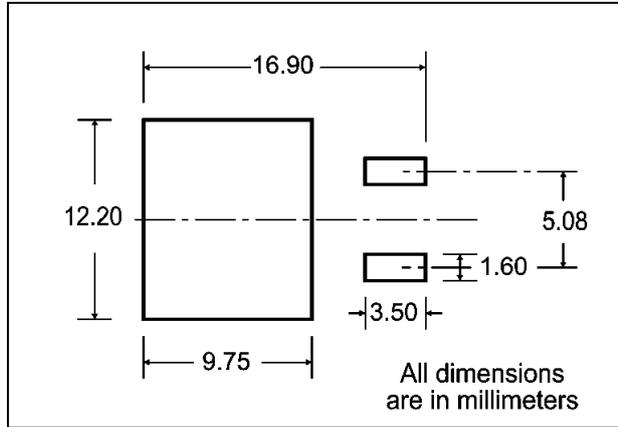
**TO-220 MECHANICAL DATA**

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |

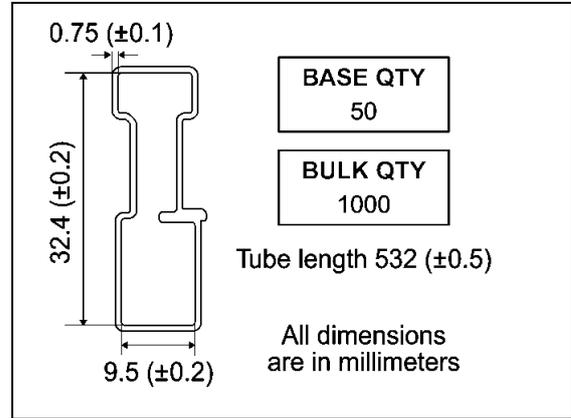


**STB80NF03L-04/-1/STP80NF03L-04**

**D<sup>2</sup>PAK FOOTPRINT**



**TUBE SHIPMENT (no suffix)\***



**TAPE AND REEL SHIPMENT (suffix "T4")\***

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

**REEL MECHANICAL DATA**

| DIM. | mm   |      | inch  |        |
|------|------|------|-------|--------|
|      | MIN. | MAX. | MIN.  | MAX.   |
| A    |      | 330  |       | 12.992 |
| B    | 1.5  |      | 0.059 |        |
| C    | 12.8 | 13.2 | 0.504 | 0.520  |
| D    | 20.2 |      | 0.795 |        |
| G    | 24.4 | 26.4 | 0.960 | 1.039  |
| N    | 100  |      | 3.937 |        |
| T    |      | 30.4 |       | 1.197  |

| BASE QTY | BULK QTY |
|----------|----------|
| 1000     | 1000     |

**TAPE MECHANICAL DATA**

| DIM. | mm   |      | inch  |        |
|------|------|------|-------|--------|
|      | MIN. | MAX. | MIN.  | MAX.   |
| A0   | 10.5 | 10.7 | 0.413 | 0.421  |
| B0   | 15.7 | 15.9 | 0.618 | 0.626  |
| D    | 1.5  | 1.6  | 0.059 | 0.063  |
| D1   | 1.59 | 1.61 | 0.062 | 0.063  |
| E    | 1.65 | 1.85 | 0.065 | 0.073  |
| F    | 11.4 | 11.6 | 0.449 | 0.456  |
| K0   | 4.8  | 5.0  | 0.189 | 0.197  |
| P0   | 3.9  | 4.1  | 0.153 | 0.161  |
| P1   | 11.9 | 12.1 | 0.468 | 0.476  |
| P2   | 1.9  | 2.1  | 0.075 | 0.082  |
| R    | 50   |      | 1.574 |        |
| T    | 0.25 | 0.35 | .0098 | 0.0137 |
| W    | 23.7 | 24.3 | 0.933 | 0.956  |

10 pitches cumulative tolerance on tape + / - 0.2 mm

User Direction of Feed

Center line of cavity

TRL

FEED DIRECTION

Bending radius R min.

\* on sales type

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## STB80NF03L-04/-1/STP80NF03L-04

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